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ABSTRACT

These four papers are from a symposium that was facilitated by Richard J. Torraco at the 1995 conference of the Academy of Human Resource Development (HRD). "Performance Technology--Isn't It Time We Found Some New Models?" (William J. Rothwell) reviews briefly two classic models, describes criteria for the high performance workplace (HPW), and poses some questions about the possible need for new models to guide human performance improvement that are attuned to the HPW. "Blocks to Improving Performance: Results of an Experientially-Based Group Exercise Using Gilbert's Behavior Engineering Model" (Peter J. Dean, Martha Ray Dean, Rebecca Rebalsky) reports findings of a study that asked participants to identify the factor that, if improved, would contribute the most to the improvement of their work performance. "Emerging Issues in the Reengineering of Corporate Performance Evaluation and Development" (Margaret L. Bailey, Danilo M. Baylen) reports a study that identified issues in three key areas: common performance management (PM) system elements, issues and barriers identified during design and implementation of PM, and strategies used to manage identified issues and barriers. "The Human Resource Developer and the Engineer: New Partners for a New Century" (Peter A. DeLisle) advances the proposal that the two professions best prepared to meet the business and organizational challenges of the millennium and beyond are HRD specialists and practicing engineers. (YLB)

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Performance Technology: Isn't It Time We Found Some New Models?
William J. Rothwell, Pennsylvania State University

Blocks to Improving Performance: Results of an Experientially-Based Group Exercise Using Gilbert's Behavior Engineering Model
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The Human Resource Developer and the Engineer: New Partners for a New Century
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Performance Technology--
Isn't It Time We Found Some New Models?

William J. Rothwell
The Pennsylvania State University

HRD professionals and performance technologists have been well-served by several classic models for separating training from nontraining needs and for identifying the appropriate performance improvement intervention to address a human performance problem. However, even classic models have their faults and become outdated. In this article the author briefly reviews two classic models, makes some personal observations about their possible strengths and weaknesses, describes the newly-released criteria of the so-called High Performance Workplace (HPW) identified by the U. S. Department of Labor, and poses questions for reader consideration about the possible need for new models to guide HRD professionals and performance technologists in choosing appropriate performance improvement strategies to anticipate or solve human performance problems.

It is always fun--and occasionally useful--to play the role of devil's advocate. Allow me to adopt that role in this paper for a simple, harmless but high-minded purpose: let's set out on the road to discovery to determine whether we might be in need of a new model (or even new models) to guide human performance interventions. If the classic models still work well enough, that is good to know. But there may be new ways to look at these issues that may help us more if we could break out of old paradigms.

Let me state at the outset that my aim here is not to diminish in the slightest the fine work done by the greats in the field. To paraphrase Isaac Newton, "we stand on the shoulders of giants"; and, to paraphrase T. S. Eliot, "great authors are never irrelevant and are always worth reading precisely because *they are what we know*." In short, we could not have an informed discussion about reinventing models to guide human performance technology were it not for the fine work done by many inventive people in many disciplines.

My plan here is a modest one, befitting the limited space I have. First, I will *briefly* describe two classic models that have been used to guide human performance improvement interventions. (That section will be very short because I will assume that most of my readers are familiar with these models.) Second, I will make some observations about what I consider to be their possible strengths and weaknesses. Third, I will describe the criteria for the so-called High Performance Workplace (HPW) recently identified by the U. S. Department of Labor. Fourth and finally, I will pose some questions for reader consideration about the *possible* need for new models to guide human performance improvement that are attuned to the HPW. I hope that this paper may stimulate true debate--and perhaps even lead to some ideas about new models to guide performance technology.

Classic Models

Two classic models have long dominated the landscape of human performance technology. One is Thomas Gilbert's (1978) *Behavior Engineering Model*; the other is Mager and Pipe's (1970) *Performance Analysis Model*. Of course, much has been written about human performance technology models in recent years.

Gilbert's Behavior Engineering Model. Perhaps best thought of as a comprehensive model that can be used to do an analysis of the performance landscape for an entire organization (Rothwell & Sredl, 1992), Gilbert's model lists six key vantage points for organizational analysis:

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Chart 1: Gilbert's Vantage Points for Analyzing Performance	
Vantage Point	**Key Questions for Consideration**
The philosophical level	What are the ideals of the organization?
The cultural level	What is the larger culture in which the organization functions?
The policy level	What missions define the organization?
The strategic level	What plans are designed to help the organization achieve its mission(s)?
The tactical level	What duties have been defined to help achieve strategies?
The logistical level	What support systems (including resources, information, etc.) have been established to help employees carry out their duties?

Gilbert's central contention is that, to achieve desired ***accomplishments*** (what some might call *work outcomes* or *work outputs*), an organization must achieve congruence at each level. Necessary support systems and other systems must be in place that will ensure that desired results can be achieved.

A key advantage of Gilbert's model is that it implicitly acknowledges the importance played by the work environment in establishing the basis for exemplary performance. In short, individual workers--while they can be a source of performance problems--can never achieve high performance when the organizational environment creates a barrier to performance. (This is a line of thinking with which quality guru W. Edwards Deming would strongly concur.)

For Gilbert, one key to improving individual performance is to examine what he calls performance improvement potential (PIP). That is measured by comparing the accomplishments of exemplary performers to the accomplishments of all other performers to determine the real-world possibilities for performance improvement. That measure can be powerfully persuasive to skeptical decision-makers.

Mager and Pipe's (1970) Performance Analysis Model. Long a favorite of many HRD professionals, Mager and Pipe's performance analysis model is properly viewed as a situation-specific model (Rothwell & Kazanas, 1992; Rothwell & Sredl, 1992). It can help troubleshoot performance problems in specific situations when decision-makers plead for help or when HRD professionals encounter performance problems.

The starting point for Mager and Pipe's flowchart model is a description of a performance discrepancy, a difference between ***what is*** and ***what should be***. From that point the user of the model is guided through a series of steps to troubleshoot the nature of the problem, its underlying cause, and appropriate solutions. Key to using the model is distinguishing between a skill deficiency (which may lend itself to a training solution) and another (management) deficiency (which lends itself to a nontraining solution).

Mager and Pipe's model is marvelously useful. It steps the user through such possible questions (under yes, it is a skill deficiency) as: (1) "is the performer used to doing it?" (2) "is the skill used often?" It also steps the user through such alternative questions (under no, it is not a skill deficiency) as: (1) "is performance punishing?" (2) "is nonperformance rewarding?" (3) "does performance matter"; and (4) "are there obstacles to performance?"

Strengths and Weaknesses of the Classic Models

Both Gilbert's model and Mager and Pipe's model have real value in addressing workplace problems. (Some organizations have realized gains just by training their supervisors or employees on how to apply these models.) However, both models have some real strengths and weaknesses.

Gilbert's model properly examines the organizational environment against a backdrop of myriad influences. Mager and Pipe's model provides a powerful and inherently practical tool for trainers, performance technologists or even line managers and employees who encounter a performance problem.

Gilbert's model, however, is exceptionally difficult to explain to people--at least I have found that to be true. Moreover, it provides few clues--without supplementing it with other models from Gilbert--on precisely how to solve performance problems, identifying when it is possible to derive an appropriate combination of appropriate performance improvement interventions to address a vexing performance problem identified on several levels. Gilbert's reliance on the performance level of the exemplary performer, while quite useful when persuading skeptical managers about the possibilities for improvement, can implicitly limit the organization to "the best of what we currently do" rather than encourage "breakthrough thinking" that leads to quantum leaps in performance gains.

On the other hand, Mager and Pipe's model promotes--no doubt unintentionally and for the sake of the simplicity of the model-- the logical fallacy of *either/or thinking*. Performance technologists and other users are (unfortunately) led to conclude that any performance problem results from either a skill deficiency or a management deficiency. Never the twain shall meet? In real world settings, however, it is commonplace to find many problems that represent a *combination* of skill and management deficiencies. What then? How can the performance technologist use the model when it is both a skill deficiency and a management deficiency?

The U. S. Department of Labor's Criteria for HPW

The move to so-called high performance workplaces (HPW) has rightly prompted continuing attention to the factors affecting worker performance inherent in the work environment. According to the Department of Labor, the criteria for assessing a high performance workplace include the following, which may (arguably) imply a new model to guide human performance improvement interventions and human performance troubleshooting:

Chart 2: HIGH-PERFORMANCE WORKPLACE PRACTICES CRITERIA		
I. **SKILLS AND INFORMATION**	I.1 *Training and Continuous Learning*	I.1.1 Investments in training and employee development reflect a higher proportion of payroll than competitors.
		I.1.2 There are programs to support continuous learning (e.g., job rotation and cross-functional team training).

		I.1.3a Training program effectiveness is measured.
		1.1.3b Training programs are effective.
	I.2 Information Sharing	I.2.1 All workers receive information on operating results, financial goals, and organizational performance.
		I.2.2 Employees are appropriately trained to apply information on the organization's operating results, financial goals, and its organizational performance
		I.2.3 There are multiple mechanisms by which internal communication occurs so that information flows up, down, and across the organization.
II. PARTICIPATION, ORGANIZATION, AND PARTNERSHIP	*II.1 Employee Participation*	II.1.1 Workers are actively involved in continuously improving their work rocess(es) and redefining their jobs.

		II.1.2 Workers can rapidly modify their work processes to correct quality, safety, or other problems.
		II.1.3 Workers are actively involved in problem-solving, selecting new technology, modifying the product or service provided, and meeting with customers.
		II.1.4 When individuals or teams make suggestions, they always receive feedback about their suggestions.
	II.2 Organization Structure	II.2.1 The organization has recently made one or more efforts to reduce layers of management.
		II.2.2 Most workers are organized into work teams with substantial autonomy.
		II.2.3 There are cross-functional teams or other mechanisms to share innovative ideas across organizational boundaries.

	II.3	*Worker-Management Partnerships*	II.3.1 Workers and their representatives are partners in decision making on a range of issues traditionally decided solely by managers (e.g., new technology, quality, and safety).
			II.3.2a If the organization is unionized, the union-management relationship has moved toward joint participation and decision making.
			II.3.2b If the organization is unionized, collective bargaining is based on interest-based techniques and cooperative problem solving.
			II.3.3 If the organization is unionized, the company and the union have engaged in innovative collective bargaining arrangements.
III. COMPENSATION, SECURITY AND WORK ENVIRONMENT	*III.1*	*Compensation Linked to Performance and Skills*	III.1.1 The organization's incentive system incorporates new ways of rewarding workers.

		III.1.2 Individual workers or work teams receive financial rewards when they improve the product, the work process, or make other improvements.
		III.1.3 Individual compensation is tied to both individual and corporate performance.
		III.1.4 Executive pay is tied to corporate (or business unit) performance.
	III.2 Employment Security	III.2.1 Comprehensive organization employment planning strategies and policies exist in order to minimize or avoid lay off of workers.
		III.2.2 If layoffs have occurred in recent years, the organization's actively helped laid-off workers find new jobs.

		III.2.3 The organization has a stated policy that workers will not suffer adverse effects from suggestions that result in productivity gains.
	III.3 Supportive Work Environment	III.3.1 The company attracts and retains a talented work force. (Issue to consider: Why do people leave?)
		III.3.2 There are policies and programs in place to encourage better employee morale and greater work-force commitments. (Issue to consider: What practices are in place to ensure that all problems with morale are promptly and systematically addressed?)
		III.3.3 Employees are actively involved in designing and implementing health and safety policies and programs.
		III.3.4 Accident rates in this organization are below the industry average.

			III.3.5 Family-supportive policies (e.g., flexible work schedules, child care, and/or elder-care) are in place.
			III.3.6 The organization actively hires, trains, retrains, and promotes a diverse work force.
IV.	**PUTTING IT ALL TOGETHER**	*IV.1*	*The company fully integrates its human resource policies and workplace practices with other essential business strategies.*
		IV.2	*Quality and continuous improvement efforts are meshed with training, work organization, employee involvement, and alternative compensation programs.*
		IV.3a	*Workers are involved in the design and purchase of new technologies.*
		IV.3b	*Workers have the opportunity to regularly modify the technologies they use.*
		IV.3c	*Employees receive adequate training to use new technologies effectively.*

Source: *Road to high performance work organizations*. (1994). Washington, DC: U. S. Department of Labor, Office of the American Workplace. Not copyrighted.

Questions for Consideration

Consider the following questions:

- How enduring are the classic models that guide human performance technology? How

applicable to the 1990s are they?

- In view of the growing number of performance improvement interventions listed in Stolovich and Keeps (1992), how well do the classic models of human performance technology help us to identify *when* to use different performance improvement interventions *alone or in combination*? How well do the models of Gilbert and Mager and Pipe address when to use large-scale performance improvement interventions or small-scale interventions?

- What modifications, if any, should be made to performance improvement models based on the implications of the high performance workplace criteria?

Conclusion

My aim in this paper has been to direct attention to the possible need to review classic models guiding Human Performance Technology with a view toward finding models that capture ways to match the most appropriate performance interventions with performance problems. The classic models, while they remain enduring and useful, may require review and consideration in the workplace of the 1990s. That accounts for the title of this paper: "Performance Technology--Isn't It Time We Found Some New Models?"

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Blocks to Improving Performance: Results of an Experientially-Based Group Exercise Using Gilbert's Behavior Engineering Model

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Training is often the performance improvement solution of choice, Yet, how often does the best training not yield performance improvement. There is a growing body of knowledge that indicates that many times performance improvement can be achieved faster, cheaper and better by altering factors in the workplace than by training. This paper addresses this issue, reporting on a study in which employees were asked to indicate what kind of interventions would best improve their performance.

It is the responsibility of HRD professionals to increase the "learning capacity of individuals, groups, collectives, and organizations through the development and application of learning-based interventions for the purpose of optimizing human and organizational growth and effectiveness" (Chalofsky, 1992, p. 179). Traditionally, this has been accomplished through training and training is on the rise. A survey by Lakewood Research projected that U.S. businesses would spend $50.6 billion for formal training this year, an increase of five percent from the 1993 total of $48.2 billion (1994). With these increased expenditures, however, organizations are increasingly concerned about the return on their training investment.

One of the factors that influences the degree to which training results in the desired individual and organization performance improvement is whether training was the appropriate intervention to improve performance to begin with. This factor can be addressed through a needs assessment. The problem is, needs assessments are seldom done (Dean, 1995a), despite the growing evidence that human and organizational growth and effectiveness can be improved by workplace interventions that consume less time and money than training. One source of this evidence is from employees themselves.

This paper reports the findings of a study that asked participants to identify the factor that, if improved, would contribute the most to the improvement of their work performance. The factors they had to choose from included the environmental factors of information, resources and incentives, or the individual factors of knowledge, capability or intrinsic motivation. Results indicate that the majority of participants perceive that improvement in environmental factors - not training - would contribute the most to their performance improvement. A discussion of implications of these results for the HRD profession concludes the paper.

Background and Purpose

In 1978, Thomas Gilbert wrote *Human Competence: Engineering Worthy Performance*. In this book, he described a series of techniques that could be used to "engineer" the improvement of employee performance from an average or below average level to an exemplary level. Included among these techniques was the Behavior Engineering Model (Figure 1) which focuses on fixing the environment in which the person works instead of placing the emphasis of performance improvement on fixing the person. With the Behavior Engineer Model, those individuals responsible for performance improvement and maintenance could diagnose for, prioritize and plan performance improvement solutions.

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The three cells along the top row of the model, information, resources, and incentives, represent factors of the work environment that influence performance. When these performance support factors are provided for, employees are empowered to perform at an exemplary level. But when the support factors are not provided; even with specialized training, performance cannot reach its potential.

It was Gilbert's contention that the absence of performance support factors in the work environment is, in fact, the single greatest block to exemplary performance. This is why, in identifying the solutions that will yield performance improvement; it is essential to begin by identifying any of the support factors in the work environment that might be missing. Gilbert believes that the majority of time, performance improvement can be achieved by addressing the environmental support factors alone, yet traditionally managers and human resource specialists assume that the individual, not the environment needs "fixing" and thus training is provided as the performance improvement solution of choice. When this assumption is wrong, several things occur.

- The performance doesn't improve to the degree that it is expected to, and as a result, the training, the trainer, those who planned the training and/or the employee are discredited.
- More money is spent on an ineffective solution, than would have been required to address most environment support factors.
- The disparity between the average and exemplary performance remains.

Of course there are many instances in which the appropriate performance improvement solution does involve the employee directly.

Figure 1 Behavior Engineering Model

Stimuli	Response	Consequences
Cell 1 - E **Information**	Cell 2 - E **Resources**	Cell 3 - E **Incentives**
• Descriptions of what is expected of performance • Clear and relevant guides on how to do the job • Relevant and frequent feedback on adequacy of performance	• Tools, resources, time and materials designed to achieve performance needs • Access to leaders • Sufficient personnel • Organized work processes	• Adequate financial incentives contingent upon performance • Non-monitory incentives • Career development opportunities • Clear consequences for poor performance
Cell 4 - I **Knowledge**	Cell 5 - I **Capacity**	Cell 6 - I **Motives**
• Systematically designed training to match requirements of exemplary performers • Opportunity for training	• Match between people and position • Good selection processes • Flexible scheduling to match peak capacity of workers • Prostheses or visual aids to augment capacity	• Recognition of worker's willingness to work for available incentives • Assessment of worker's motivation • Recruitment of workers to match realities of work conditions

E = Work Environment, I = Individual

Human Competence, 1978, p.88. Used with permission from T.F. Gilbert.

The bottom row of the Behavior Engineering Model represents factors related to the employee. The first, knowledge, comes into play when training is needed for: new job responsibilities, participation in cross-functional teams, using new equipment, and addressing gaps in knowledge and skills. In these instances, it is often not necessary to use the Behavior Engineering Model to identify the cause of performance deficiencies, because the need for training is self-evident.

The second cell on the bottom row of the Behavior Engineering Model, capacity, is the ability of the individual to perform the job. It is represented by a match or a mismatch between the employee and the job requirements. Here the effectiveness of the selection process is crucial.

It is Gilbert's contention that motivation, the third factor related to the individual, will be high if all of the other cells, especially those related to work environment, are provided for. Thus

It is Gilbert's contention that motivation, the third factor related to the individual, will be high if all of the other cells, especially those related to work environment, are provided for. Thus he believes that evidence of low motivation is a red flag to look for deficiencies in information, resources or incentives. In communicating this concept, the authors stress that factors in the work environment will not directly motivate employees, rather they can create an environment in which the employees' own intrinsic motivation can flourish.

Gilbert believes that any job that is supported in all six of the areas of the Behavior Engineering Model should "carry a guarantee of high competence, provided that management was structured so as to really deliver these things and had a clear focus on the mission of the job in the first place" (1978, p. 87).

Dean (1994) used Gilbert's Behavior Engineering Model as the basis for an experiential group exercise, "Where's My Biggest Performance Block?" Dean's exercise asks participants to identify one of Gilbert's six factors as the source of limitations to their own improved performance. In this paper, results from the exercise will demonstrate that participants, regardless of their role or level of responsibility, are more likely to identify environmental factors rather than individual factors as holding blocks to better performance.

A chi-square analysis of the data will demonstrate that these results are not accidental, but represent a real trend. In addition, the paper will include results from testing alternative models of the exercise which were developed to avoid the effects of primacy and recency and to explore the effect of the actor-observer bias.

Methodology

The exercise was entitled "Where's My Biggest Performance Block?" in order to convey the purpose of the exercise quickly and without an elaborate explanation that might prejudice responses. Participants in the "Where's My Biggest Performance Block?" exercise included managers, staff-level employees, members of professional societies and students in a graduate management program. Prior to the exercise, participants signed a form consenting to their involvement in this research.

In the exercise, participants are asked to respond to the question "Improvement in which one of the following six areas would enable you to do your job better?" by choosing one of the following six options. Each option relates to one of the factors in Gilbert's Behavior Engineering Model (expressed in parentheses):

1) Clear performance expectations and relevant feedback about the adequacy of your performance (Information)
2) Tools, resources and materials to achieve your performance goals (Resources)
3) Adequate pay and non-pay incentives made contingent upon your performance (Incentives)
4) Systematically designed training that matches the requirements of your job (Knowledge)
5) A match between your skills and the requirements of your job (Capacity)
6) Assurance of job security and social acceptance (Motivation)

For the exercise, a wall chart is positioned at the front of the room, visible to all participants. The wall chart depicts six cells numbered one through six with the first three cells stacked on top of cells four through six (see Figure 2). The wall chart thus resembles Gilbert's six-cell Behavior Engineering Model, but the cells are not labeled.

Figure 2 Wall Chart for Use with Activity

1	2	3
4	5	6

After selecting a response to the question, participants write the number corresponding to their response on a colored self-stick note. Participants then approach the wall chart and place their colored self-stick note in the cell corresponding to their selection. (Dean, 1994, p. 23-25)

After the participants place their responses on the wall chart, the exercise facilitator explains Gilbert's Behavior Engineering Model, and how each response to the exercise question (and each cell of the wall-chart model) relates to a factor influencing performance. The first three options – the top three cells of the model – represent factors in the performer's environment. Options four through six – the bottom three cells of the model – represent factors related to the performer's repertory.

The exercise facilitator asks the participants to comment on the results of the exercise as displayed on the wall chart. The clustering of the self-stick notes reveals whether most of the participants perceive environmental factors (notes clustered on top row) or individual factors (notes clustered on bottom row) as blocking better performance.

Manipulating the Exercise to Avoid Effects of Primacy and Recency Attendees of a teachers' conference participated in the "Where's My Biggest Performance Block?" exercise under slightly different circumstances than the other groups. In an attempt to avoid the influence of primacy and recency (Weiner, 1985) on participants' responses to the question, the order of the answers to the question were reversed. In addition, a color rather than a number was assigned to each answer. In response to the question, "Improvement in which one of the following six areas would enable you to do your job better?", participants could choose one of the following options:

- Assurance of job security and social acceptance (Yellow = motivation)
- A match between your skills and the requirements of your job (Blue = capacity)
- Systematically designed training that matches the requirements of your job (Red = knowledge)
- Adequate pay and non-pay incentives made contingent upon your performance (Green = incentives)
- Tools, resources and materials to achieve your performance goals (Purple = resources)
- Clear performance expectations and relevant feedback about the adequacy of your performance (Orange = information)

Therefore, the original first response became the last response, the second response became the fifth response, etc. Each participant selected a sticker which was the same color as the color corresponding to the answer selected, and then placed their stickers on the six-cell wall chart. Each cell of the wall chart was labeled by color, but the cells were labeled according to their original order. For example, the original first response (for the participants, the last response labeled "orange") was assigned to the first cell (see Figure 3).

Figure 3 Wall Chart for Use with Alternative Exercise

Orange	Purple	Green
Blue	Red	Yellow

Identifying Blocks to Better Performance in Others Attendees of the teachers conference participated in the exercise a second time. The answers to the exercise question were still reversed and color-coded; however, instead of examining the question from the viewpoint of their own performance, participants were asked to answer the question in terms of their students' performance. The question and answers were rewritten as follows: "Which one of the following six areas do your students need to improve their performance in the classroom?"

- Assurance of social acceptance and security in the classroom (Yellow = motives)
- A match between their skills and their grade level (Blue = capacity)
- Systematically designed instruction matching grade level requirements (Red = knowledge)
- Adequate incentives made contingent on their classroom performance (Green = incentives)

- Tools, resources and materials to achieve their classroom performance goals (Purple = resources)
- Clear expectations and relevant feedback about the adequacy of their classroom performance (Orange = information)

Results

Dean's "Where's My Biggest Performance Block?" experiential group exercise has been conducted with more than 850 participants over the past two years. Results show that, typically, over two-thirds of participants choose options one, two or three; the environmental factors of information, resources, or incentives – as the areas needing improvement in order to enable them to perform better.

To measure the results of the exercise for this paper, participants' responses for each cell were tallied. Percentages of total participants selecting each cell were also calculated. Also, the sum of percentages of the top three cells were compared to the sum of percentages of the bottom three cells to determine which set of factors – environmental or individual – were selected by the majority of participants.

Results were categorized according to the type of participant: staff-level employees, managers, members of professional societies, or graduate management students. Results were categorized in this manner in order to determine if participants with different roles (i.e., manager, employee or student) responded differently to the exercise. Results were also determined for the teachers' conference attendees, who participated in alternative models of the exercise. Additionally, for each category of participants, a chi-square analysis was performed. In the chi-square analysis, the actual results from the exercise were compared to theoretical results based on the null hypothesis that each cell of the model would receive an equal number of responses. If the results of the chi-square test of the observed responses and theoretical responses were greater than the critical value of x^2 at .05 level of significance and 5 degrees of freedom, then the null hypothesis was rejected.

Following are results according to the type of participant. For a graphic representation of percentages see Table 1.

Employees A total of 110 participants were staff-level employees. Of these employee participants, 39 percent selected cell one (information); 25 percent selected cell two (instruments); 18 percent selected cell three (incentives); eight percent selected cell four (knowledge); seven percent selected cell five (capacity), and three percent selected cell six (motives). Overall, 82 percent selected the environmental factors in cells one through three, and 18 percent selected the individual factors in cells four through six. Thus, more than two-thirds of the staff-level employee participants selected environmental factors. The chi-square analysis showed that x^2 equaled 91.13 and was greater than the critical value of x^2 of 11.070; therefore, for this category, the null hypothesis is rejected.

Managers Of a total of 48 managerial participants, 38 percent selected cell one (information); 27 percent selected cell two (instruments); two percent selected cell three (incentives); 19 percent selected cell four (knowledge); six percent selected cell five (capacity), and eight percent selected cell six (motives). Overall, 67 percent selected the environmental factors in cells one through three, and 33 percent selected the individual factors in cells four through six. Again, these results show a majority of participants selecting environmental factors as blocks to better performance. The chi-square analysis showed that x^2 equaled 64.33 and was greater than the critical value of x^2 of 11.070; therefore, for this category, the null hypothesis is rejected.

Employees and Managers A total of 409 participants were groups of staff-level employees and managers undergoing the exercise together. Of these participants, 29 percent selected cell one (information); 21 percent selected cell two (instruments); 29 percent selected cell three (incentives); 11 percent selected cell four (knowledge); seven percent selected cell five (capacity), and two percent selected cell six (motives). Overall, 80 percent selected the environmental factors in cells one through three, and 20 percent selected the individual factors in cells four through six. Thus, more than two-thirds of the staff-level employee and managerial participants undergoing the exercise together selected environmental factors. The chi-square analysis showed that x^2 equaled 180.58 and was greater than the critical value of x^2 of 11.070; therefore, for this category, the null hypothesis is rejected.

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Attendees of Meetings of Professional Societies A total of 191 participants were attendees of meetings of professional societies. Of these participants, 40 percent selected cell one (information); 36 percent selected cell two (instruments); seven percent selected cell three (incentives); four percent selected cell four (knowledge); 10 percent selected cell five (capacity), and three percent selected cell six (motives). Overall, 83 percent selected the environmental factors in cells one through three, and 17 percent selected the individual factors in cells four through six. Thus, more than two-thirds of these participants selected environmental factors. The chi-square analysis showed that x^2 equaled 200.67 and was greater than the critical value of x^2 of 11.070; therefore, for this category, the null hypothesis is rejected.

Table 1 Results of Responses to "Where's My Biggest Performance Block?"

Nature of Groups	Cell 1	Cell 2	Cell 3	Cell 4	Cell 5	Cell 6
Employees only	43	27	20	9	8	3
	39%	25%	18%	8%	7%	3%
110 participants		*82%*			*18%*	
Managers only	18	13	1	9	3	4
	38%	27%	2%	19%	6%	8%
48 participants		*67%*			*33%*	
Employees and managers	120	87	120	46	28	8
	29%	21%	29%	11%	7%	2%
409 participants		*80%*			*20%*	
Attendants at professional meetings	76	69	14	8	19	5
	40%	36%	7%	4%	10%	3%
191 participants		*83%*			17%	
Graduate students	12	12	4	5	3	4
	30%	30%	10%	13%	8%	10%
40 participants		*70%*			*30%*	
Teachers responding regarding their own performance blocks *	22	20	1	5	4	7
	37%	34%	2%	8%	7%	12%
59 participants		*73%*			*27%*	
Teachers responding to the performance blocks of their students *	13	6	5	0	3	31
	22%	10%	9%	0%	5%	53%
58 participants		*41%*			*59%*	

* Experienced alternative model of the exercise

Cell 1: Information Cell 2: Resources Cell 3: Incentives	Environmental Factors
Cell 4: Knowledge Cell 5: Capacity Cell 6: Motives	Individual Factors

Graduate Management Students A total of 40 participants were graduate management students. Of these participants, 30 percent selected cell one (information); 30 percent selected cell two (instruments); 10 percent selected cell three (incentives); 13 percent selected cell four (knowledge); eight percent selected cell five (capacity), and 10 percent selected cell six (motives). Overall, 70 percent selected the environmental factors in cells one through three, and 30 percent selected the individual factors in cells four through six. Thus, more than two-thirds of the graduate student participants selected environmental factors. The chi-square analysis showed

that x^2 equaled 13.1 and was greater than the critical value of x^2 of 11.070; therefore, for this category, the null hypothesis is rejected.

Manipulating the Exercise to Avoid Effects of Primacy and Recency The results from the group of teachers who responded to the alternative form of the exercise resembled results from participants who were given the original exercise. Of the 59 participants, 37 percent selected cell one (information); 34 percent selected cell two (instruments); two percent selected cell three (incentives); eight percent selected cell four (knowledge); seven percent selected cell five (capacity) and 12 percent selected cell six (motives). Overall, 73 percent selected the environmental factors in cells one through three, and 27 percent selected the individual factors in cells four through six. Even using an alternative model of the exercise, more than two-thirds of the participants selected environmental factors as the areas needing improvement in order for them to improve their own performance. The chi-square analysis showed that x^2 equaled 40.15 and was greater than the critical value of x^2 of 11.070; therefore, for this category, the null hypothesis is rejected.

Identifying Blocks to Better Performance in Others When answering this question in terms of their students and not themselves, the teachers' responses differed greatly. Of 58 participants, 22 percent selected cell one (information); 10 percent selected cell two (instruments); nine percent selected cell three (incentives); zero percent selected cell four (knowledge); five percent selected cell five (capacity) and 53 percent selected cell six (motives). Overall, 41 percent selected the environmental factors in cells one through three, and 59 percent selected the individual factors in cells four through six. Departing from the usual trend of the majority of responses favoring environmental factors; in this exercise, the majority of participants identified individual factors as limiting performance. The chi-square analysis showed that x^2 equaled 66.14 and was greater than the critical value of x^2 of 11.070; therefore, for this category, the null hypothesis is rejected.

Summary and Conclusions

For all categories of participants undergoing the original "Where's My Biggest Performance Block?" exercise, results consistently show that at least two-thirds select the environmental factors of information, resources and incentives as needing improvement in order to enable them to improve their own performance. Even when the exercise was changed to avoid the tendency of participants to select either the first or last response, results still favored environmental over individual factors. A chi-square analysis provided statistical support for the premise by demonstrating that these results are not accidental, but reflect an actual trend.

When the exercise was modified to elicit participants' responses about the performance of others, rather than themselves, however, the trend reversed (see Figure 4). A group of teachers which had identified environmental factors as limiting their own performance, largely identified individual factors as the ones blocking better performance from their students. These results may reflect the actor-observer bias as identified by Jones and Nisbett, who ". . . suggest that actors focus their attention upon the environment, but observers concentrate on the actors and their behavior." (Weiner 1980, p. 294) In this case, the teachers responded from the vantage point of actors when identifying their own performance blocks and as observers when identifying the blocks to the performance of their students.

Figure 4 Teachers' Perceptions of the Blocks to Their Own and Their Students' Performance

	Environmental Factors	Individual Factors
Teachers' perceptions of their own performance blocks	73%	27%
Teachers' perceptions of the performance blocks of their students	41%	59%

The results illustrated in Figure 4 may also be explained by attribution theory which proposes that "people tend to explain the causes of their own behavior, to themselves as well as to

others, in a self-serving manner" (Nisbett and Ross, 1980, p. 231). Although the question: "Improvement in which one of the following six areas would enable you to do your job better?" was positively worded, it implied that there is a need for improvement, that performance is not as high as it might be and that there is a problem that is inhibiting that high performance. Individuals may want to avoid attributing a performance problem to themselves and thus identify environmental areas as needing improvement. This phenomenon may have affected the teachers - along with the other participant groups - but may not have been a factor when the teachers were asked to identify the performance blocks of their students because of the actor-observor bias.

The actor-observer bias and attribution theory may further complicate the debate over which force – the environment or the individual – has greater influence on performance. Are environmental factors truly blocking better performance; and, if so, to what extent do they influence the effectiveness of training? Or, do people falsely identify environmental factors as blocks because they are naturally biased when examining themselves? These are questions that suggest opportunities for further research.

Rather than propose an answer to these questions, this paper demonstrates the importance of people's *perceptions*. Results of the exercise show that people clearly perceive environmental factors, rather than individual factors, as limiting their performance. We've seen this phenomenon in the training room as well where employees come to training believing that, despite how good the training is or how much they learn, very little will change once they return to the job - because of factors in the work place. Perceptions are powerful, and cannot be ignored. If people believe that the work environment limits their performance, then this belief must be addressed by human resource development professionals. If, instead, we focus on individual training and development, then we are not giving employees what they think they need, thus disincenting them. Nor are we addressing what may be the rea; blocks to exemplary performance.

The position of the authors is that, despite the potential influence of the actor-observor bias and attribution theory and the fact that we are dealing with perceptions, the fact that the so many participants so consistently identified environmental factors as needing improvement in order for them to do their jobs better validates Gilbert's premise the majority of time, performance improvement can be achieved by addressing the environmental support factors alone. At the very least, they must be addressed in conjunction with training.

Furhter, we believe that the "What's My Performance Block?" exercise is one way of demonstrating the importance of environmental support factors to decision makers who must be convinced of the value of a needs assessment or non-training performance improvement interventions. Feedback from participants in this ten minute exercise indicate that they not only grasped the concepts underlying the Behavior Engineering Model, but they "bought into" the concepts because they were supported by their own data.

These results of this study do not lessen the importance of training. In fact, training is more important than ever. Downsizing, job redesign and the new jobs that are being created as the result of technical and scientific advancement all require training. Additionally, performance improvement specialists are recognizing the importance of individual transformation which opens up entirely new arenas of training (Senge, 1992, Senge et al, 1994, Dean, 1995b). With the increased emphasis on and investment in training, it is more important than ever for the human resource development community to assure that the work environment will support the use of new skills and knowledge, if HRD is to fulfill its responsibility for optimizing human and organizational growth and effectiveness.

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Emerging Issues in the Reengineering of Corporate Performance Evaluation and Development

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This study identifies emerging issues and trends in the design and implementation of performance management (PM) systems in corporate environments. For purposes of the study, performance management is defined as any integrated system with the main purpose of managing, monitoring and improving employee performance. The study looks at both the existing body of literature and actual practices of two corporate organizations implementing a PM system. Issues are identified in three key areas: common performance management system elements, issues and barriers identified during design and implementation of PM, and strategies used to manage identified issues and barriers. Results showed emerging issues including an inconsistency of performance management elements in practice, variations in PM systems based on organizational factors, lack of involvement of personnel at all levels in PM system design, and more strategies required for team environments and integration of feedback systems. Recommendations for further research are made.

In recent years, a significant number of corporate organizations have moved from a performance appraisal process, historically organized and managed by a central Human Resources department, to a decentralized performance management (PM) system. Such a system attempts to effectively integrate strategic business objectives, appraisal, training and skill development, rewards and motivation into an ongoing program which is typically managed and administered by direct supervisors and managers and overseen by a Human Resources or performance/training department (Antonioni, 1994; Lawler, 1994; Bevan and Thompson, 1991). While a significant number of organizations have "jumped on the bandwagon" of a PM approach, there is limited information available to researchers or practitioners regarding issues inherent in designing and implementing an effective PM process. The authors maintain that much can be learned from the problems addressed and overcome by organizations which are currently employing a PM approach.

This study, therefore, addresses three main questions: What are the common elements in PM systems that are currently being designed and implemented in corporations? What issues and barriers have organizations identified during the design or implementation of their PM system? How have organizations successfully managed or overcome issues and barriers to designing or implementing PM?

Methods

Literature Analysis. A review and key word analysis of current literature in performance management was conducted. The authors chose ten articles that represented both theoretical and case-oriented works for keyword analysis. All articles represented theory and applications of performance management post-1982, with 90% of articles representing practices post-1991. Key word analysis was conducted by identifying distinguishing key words and phrases in each article as they applied to the three main research questions. Key words were then mapped for frequency of occurrence across the ten articles.

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Interviews. Telephone interviews were conducted, using an interview protocol, with a representative human resource or management contact at two corporations currently designing or implementing a performance management system. Both contacts were chosen based on the main selection criterion: that each is *directly* responsible for part or all of the design and implementation of the PM system. Interview questions, as with the literature analysis, centered on the key elements of the organization's PM system, barrier/issues experienced and strategies used to overcome the described barriers.

Results

Literature Analysis. Tables 1, 2 and 3 show the key words/phrases that emerged during analysis, and the frequency of occurrence across the ten articles.

Table 1. Key word Analysis: Common elements of Performance Management Systems

Keywords or phrase	*Number of Occurrences*	*(n/10)*
Goal Setting/Performance Targets	9	.90
Feedback Systems	9	.90
Formal individual performance review	9	.90
Link to business strategy/plan	8	.80
Formal performance planning	8	.80
Professional development	8	.80
Link to reward system	8	.80
Coaching	7	.70
Involvement of individual in process	7	.70
Performance-based pay	6	.60
Team performance reviews/ team-based pay	2	.20

Table 2. Key word Analysis: Issues/Barriers in the Design/ Implementation of Performance Management Systems

Keywords or phrase	*Number of Occurrences*	*(n/10)*
Lack of integration of PM processes	9	.90
Senior management attitudes/practices	8	.80
Communication	7	.70
Varying practices in implementing PM	7	.70
Linking PM with rewards/ compensation	7	.70
Employee attitudes	7	.70
Need to change corporate culture	6	.60
Level of coaching skills	5	.50
Building trust in the new system	5	.50

Table 3. Key word Analysis: Strategies Used to Address Barriers/Issues

Keywords or phrase	*Number of Occurrences*	*(n/10)*
Ensure development-driven integration	10	1.00
Emphasize feedback/coaching	9	.90
Involve individuals at all levels	8	.80
Emphasize shared responsibility of managers and individuals	7	.70
Train at all levels	6	.60
Communicate broadly	5	.50
Provide support and resources	5	.50

Interview with Organization A. Organization A is a large training division of a global organization. Approximately 600 employees are affected by the current performance management system. After about 18 months of needs analysis and design, the organization is in pilot implementation of a new system which replaced a traditional bi-annual performance appraisal. The new system was established in response to an internal employee satisfaction survey which was part of a Total Quality Management initiative. The survey revealed, among other areas, a need for strengthening feedback and the quality of supervision. A senior member of management who has been involved during design and implementation of the system was interviewed.

Elements of the Current Performance Management System. The new PM system is a development-driven system centered on a cyclical process which begins with the manager and individual working together to set initial performance expectations. During the initial meeting, personal goals and the organization's goals and strategies are discussed, as are criteria/measures for assessing performance outcomes and professional development plans. Performance and professional development are then reviewed through at least two scheduled feedback sessions, a formal mid-year progress check and formal annual performance review. Ongoing coaching and feedback are also emphasized. At present, the organization is retaining a merit-pay system, but is evaluating stronger links between the performance management and the compensation/promotion systems.

Expressed goals of the system include:

- Ensure the products and services of each workgroup in the organization align with the expressed goals of the division and global organization.
- Identify the competencies required of individuals who deliver the products and services.
- Identify individual training and non-training options/strategies to support the development of competencies.
- Assess performance as input to development, promotion and salary administration.
- Provide for career management and progression through establishment and monitoring of professional development plans.

Barriers/issues. (1) Consistency Across Workgroups. Although the new system has garnered mostly positive reaction at all levels during pilot implementation, a few challenges have presented themselves throughout the design and implementation of the new PM system. During design, the greatest challenge was to design a system that would work across all job types and positions within the division. There was a goal to strive for consistency in the process to ease learning and implementation of the system. Much of the challenge centered on the effort to define competencies/standards across workgroups. As the project progressed, it was clear that there were clear differences among workgroups in regards to products and services, customers and resulting job skills and expectations. (2) Time and Resource Constraints. In addition, throughout the process, time and resources were a barrier. Ensuring a smooth roll-out among 600 employees requires time and commitment from all employees. (3) Training Issues. Finally,

the greatest challenge during implementation centered on the need to ensure that everyone in the system had the information and skills required to work effectively through a new system.

Strategies Used to Address Barriers. (1) Consistency Across Workgroups. The organization used two strategies in designing the system that allowed for consistency within the process while still allowing for flexibility within workgroups. The first centered on establishing buy-in among workgroup leaders to the core steps of the performance management cycle (e.g., reviewing products and services, professional development planning, reviews, etc.) This was done through a series of "strawman" facilitated focus groups. The agreed upon process, then, would be applied consistently across workgroups. The second strategy was to divide competencies into two groups: those areas that all employees in the division should be competent in (general and leadership competencies) and areas of competency that are position-specific which the workgroups would be responsible for defining. (2) Time Constraints. Each workgroup developed their own strategy to meet pilot implementation rollout dates which varied from outsourcing steps to a facilitator, developing workteams, etc. (3) Training Issues. The organization viewed this area as critical and employed many strategies for meeting communication and training needs. These included:

- Broadcast e-mail and voice mail messages from top senior management.
- A series of information sessions conducted with each workgroup with required attendance.
- A manual distributed to each employee at the information session with explanations and samples of each step in the process.
- An interoffice electronic bulletin board set up for conversations and questions. The interactions were monitored by knowledge managers (usually human resources personnel) who could answer issues and questions.
- A hotline established on voice mail.
- A series of informal brown bag discussion groups.

Comparison/Contrast with the Literature. The interview with Organization A revealed many consistencies with the literature on performance management practices. Primarily, Organization A's system is development-driven, rather than reward-driven. It employs many principles of total quality management, including involvement of individuals in the PM process and integration of business strategy. There is an underlying emphasis on feedback and coaching, although the interview did not reveal specific strategies or elements targeted at this goal. Elements which are *not* currently part of the system include a strong link to compensation systems, performance-based pay, team rewards such as gainsharing, or 360-degree peer review.

Interview with Organization B. Organization B is a small management consulting company. It has about 26 employees that are affected by the current performance management system. These employees are categorized into three groups: supervisors/managers, associates/consultants, and the production staff. Two-thirds of the supervisors/managers directly supervise production staff. Associates/consultants are supervised by one of the three partners/owners. The current PM system is, for the most part, a reward-driven system comprised of a variety of elements that are in different phases of design or implementation: a quarterly 360-degree peer review (pilot implementation), an accomplishment/assignment review (design), and a qualification system (design). In addition, the associates/consultants' performance is assessed by their billable rate on a daily or percentage basis and through client feedback.

For a small organization, the current PM system is a first level response to changing organizational dynamics. A year ago, all employees reported to one of the three partners/owners. With an increase in business activities and in the number of production staff and associates/consultants, senior management agreed that the old system needed an improvement. The senior member of the management team interviewed responded that the old, informal system that worked well for 12 or less people a year ago did not work well with the number of people that they have currently.

Elements of the Current Performance Management System. A central element of the new system includes the adoption of a quarterly 360-degree peer review system. This is regarded as feedback that provides a holistic view of an individual's performance as he or she

relates with internal customers. The billable rate system is another element which applies to associates/consultants only. Rates are based on credentials and marketability and are used as a primary performance measure. The partners/owners manage and periodically review the rates of the associates/consultants based on performance outcomes and client feedback. Billable rates do not apply to the production staff. Finally, the qualification system is designed to track the skills acquisition/development of employees and structure rewards for gaining new marketable skills.

Expressed goals for the system include:

- Ensure that the system is fair according to the needs and skills of each employee.
- Provide a total compensation and benefits package.
- Compensate for skills that are valued by the organization.
- Develop a balance between team and individual motivation.
- Link business matrix and goals.
- Reinforce and reflect the organization's values (e.g., honesty, diversity, etc.)

Issues and Barriers. Since the new system has just recently been put into place, issues and barriers to implementation are not yet fully apparent. As new procedures are implemented, new barriers will emerge. However, the 360-degree peer review has garnered some reaction among employees. During the pilot implementation of the 360-degree peer review, employees provided feedback that they were apprehensive with the review procedures (i.e., concerned that they will be "nailed" by one of their peers.) After the first review, employees provided feedback akin to a sigh of relief. They found the review had less negative undertones than expected and identified areas for growth and improvement. Even still, the second 360-degree peer review created a fair amount of apprehension, although not as great as the first.

Strategies Used to Address Issues and Barriers. Based on initial reaction to the 360-degree peer review, efforts to communicate the changes in the PM system in various forms and media were prioritized. The announcement of the new system has found space in the organization's newsletter, electronic mail system, and common areas' bulletin boards. The senior member who was actively involved in the design/implementation has made himself more accessible to anybody who has questions/issues. Comments or opinions, signed or not, were welcomed and addressed during staff meetings. Finally, results of an actual peer review of one of the partners was published and distributed to the rest of the staff to generate open discussion.

Comparison/Contrast with the Literature. The interview with Organization B provided a different perspective in the design and implementation of a PM system when compared to the literature. Organization B's system is a combination of features that are in different phases of design or implementation.

Organization B shows consistency with the literature in its goal to link the PM system to the business strategy/plan. Another consistency is inclusion of periodic performance and compensation reviews.

360-degree peer review seems to be a significant and unique element in Organization B's system. This element occurred once in the set of articles reviewed. This may suggest that 360-degree peer review is a relatively new PM strategy which is just emerging in practice.

The organization's qualification system provided the PM system with a link between development/skills acquisition and reward-driven integration. Organization B's system currently heavily emphasizes a reward-driven integration. However, with the introduction of 360-degree reviews and the qualification system, the PM system is moving in the direction of a more development-driven system.

Discussion and Recommendations for Future Research

This study identified some emerging issues impacting the design or implementation of an effective performance management (PM) system. In reviewing the results from the literature analysis and interview transcripts, the data suggests emerging issues and patterns.

A summary of these issues as identified by the researchers are categorized below with corresponding questions for further research.

Issue: The definition of performance management and its key elements is consistent in theory, but varies in practice. In theory, performance management is consistently viewed as an integrated system with the main purpose of managing and improving employee performance. In practice, there exists a division of how PM is pragmatically designed within organizations. There appears to be an evolution of at least two distinct design orientations: reward-centered designs (those that focus on compensation, rewards, and performance outcomes) and development-centered designs (those that focus on skills/competencies, growth, coaching, and training.) Research is suggested in the following area(s):

- Which orientation tends to be more effective?
- What drives an organization's decision to orient toward reward-centered or development-centered designs?

Issue: The PM system may vary in design based on organizational factors (e.g., size, structure, industry, products, outputs, etc.). There was marked difference in the designs of the PM systems between the study's two interviewees. This may be due, in part, to the differences in the size and nature of the organizations' businesses. This may suggest research on the following questions:

- In the design of the PM system, what factors are considered by organizations in choosing what system to adopt or develop?
- How does the organizational structure (e.g., hierarchical, horizontal/flat, decentralized, etc.) influence the choice of a PM system?
- How does the size of an organization (e.g., small, medium, or large) affect the choice of key elements in a PM system?
- Are there common elements of PM systems within and across industries?

Issue: The identified stakeholders and the involvement of personnel at all levels of the organization during the design of PM systems varies dramatically. While it was common for PM systems to involve different levels of personnel during the *implementation* of a new system, owners and stakeholders tend to be limited to senior management during *design*. This may suggest further investigation as follows:

- Are PM systems more effective when all levels of personnel are involved in the design of the system?
- What strategies are used to ensure that every member of the organization becomes a stakeholder in the design of a PM process?
- Are there phases of PM system design that are more critical for individual involvement?

Issue: Organizations which focus on team performance over individual performance may require PM systems of varied design. At least two articles suggested a need for performance management systems consistent with the move toward self-directed teams. A need for proven strategies for review, compensation and feedback in team settings were particularly noted.

- What are current strategies of organizations structured in teams with designing and implementing performance management?

Issue: Feedback systems were emphasized in theory, but lacked clear and consistent implementation strategies in practice. While 90% of the articles reviewed, and both interviewees espoused the importance of feedback to performance management in theory, limited information was provided on the practical strategies used to ensure feedback was applied consistently and effectively at all levels.

- What evidence exists regarding the effectiveness of different feedback strategies?
- What kind of preparation do managers and staff need to ensure feedback is applied effectively within the PM system?

The authors feel that this list represents the most pressing of the issues emerging from this study which will have the greatest impact on the design and implementation of performance management systems. This study represents one step toward better understanding of PM and future research efforts.

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The Human Resource Developer and the Engineer: New Partners for a New Century

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In this dialogue, Professor DeLisle will advance the proposal that the two professions best prepared to meet the business and organizational challenges of the millennium and beyond are: the women and men educated as human resources development specialists and those trained as practicing engineers. The thesis is centered on the premise that these two groups are best suited and most likely to encounter change and discontinuity with the agility needed to prevail to include a strong commitment to interpersonal effectiveness and lifelong learning. The paper will examine the predominant paradigm of each group, citing contextual and empirical evidence from the professions, and use the construct of dominant problem-solving styles of each group as a medium to show their need and opportunity to collaborate.

From this articulation, strong implications are seen to the compelling need for efficient models of self-directed learning in industry, the growth and development of systemic critical self-reflection in engineering enterprise, and the necessity for the HRD professional to embrace and enhance the introduction of socio-technical systems to the practice of human resource development.

In what seems like another lifetime ago, I worked as a Personnel Manager for Hewlett-Packard Company in Colorado Springs. I had a R&D Manager who was, without a doubt, one of the smartest people I had ever encountered. His strengths were abundant, as a technical contributor, and he certainly knew his way around a profit and loss statement, but there was something missing. We both knew what it was; we just didn't like talking about it very much. It was his interpersonal effectiveness. Don't get me wrong, he was a thoughtful and effective person, but the gap between one set of skills and the other was so great, he looked inept. This had a direct bearing on his perceived effectiveness as a manager. I was his opposite, no technical skill, lots of people savvy. We concluded that between us, we made one good human being. That began my career. The question I sought to answer was: how do engineers develop the interpersonal effectiveness necessary to lead human enterprise? In a relatively simple setting, I had discovered a compelling question, that led me to investigation, study and articulation in this work.

To begin to answer this question, one must understand engineers and the nature of their work. I have often been accused of being engineer-friendly, as in user-friendly. It's because I have a profound admiration for their skill and capability. I like engineers. If for no other reason, it's because they do things that I could never attempt to do. Mostly, it's the way that they think. With that in mind, I began to study the nature of the engineer/scientist, and tried to determine what made them tick. In this endeavor, I turned to a classic in scientific thought, an essay written in 1962, by Thomas S. Kuhn, then a junior fellow at Harvard, but later a professor of philosophy at MIT. In his work, The Structure of Scientific Revolutions, Kuhn describes the fundamental mindset of the scientist and engineer. It is in Kuhn's work that I started to see a glimmer of the bridge that would span the world of the engineer and that of the human resource developer.

Around the same time, I was introduced to Malcolm Knowles, intellectually and personally. Malcolm articulated the other side of the equation quite well. In his dialogue, and his writing *Self-Directed Learning*, he outlined the cognitive climate and the assumptions necessary to create a viable learning environment for adults. One of his fundamental premises was that learning was problem-centered and not subject-centered. Knowles had the confidence to trust that intelligent adults, when confronted with a problem, would move to resolve the issue through whatever means necessary, and learn the necessary skills to do so. They would "engineer" a solution, so to speak. The convergence of thinking here is no mere coincidence. Both Knowles and Kuhn, scholars of the same generation saw the similarity in the forces effecting growing organizations, and articulated some important considerations for us.

Kuhn's premise is very simple and elegant. By the way, this is the ideal state of all engineering endeavor: simple and elegant. Kuhn contends that all scientific endeavor has been shaped by the prevailing

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paradigm of the time. Paradigm, in this context, is a unifying view of the universe, shared by many, that articulates otherwise disjunct ideas. He goes on to state: "a paradigm is rarely an object for replication, rather it is like a judicial decision in common law; it is an object for further review and specification under new or more stringent conditions". In this he also illustrates the premise of all science and engineering. Simply stated, a paradigm is a way to organize thinking, until a better way is found. The interesting by-product of this view is that engineers and scientists are fickle. They hold tenaciously to a concept and treat it as a moment of truth, until something better comes along. At this point, they abandon the "truth" and embrace the new idea with alacrity. Fickle, or conceptually flexible? Go figure.

Kuhn goes on to state that "normal science has a built-in mechanism that ensures the relaxation of the restrictions that bound research whenever the paradigm from which they derive ceases to function effectively." The motivating force that drives all engineering and science is the search for the truth, not in the philosophical sense, but in the practical, or pragmatic. I believe that Kuhn's contribution is more important now that it was thirty years ago.

Technology has been driven by a phenomenon called Artificial Selection by historian, Daniel Boorstin. His premise is that all useful technology drives demand. This can be as simple as an electric light (don't know how we lived without it), to memory on a computer. I used to think that a megabyte of memory was useful. The rules change, constantly and deliberately, and geometrically. Conceptual flexibility is critical to success. Those unwilling to accept the nature of change, embrace obsolescence. Thomas Kuhn is the chief apologist of the knowledge revolution, essentially embracing the need to continue learning, as a premise of professional competence. Surprisingly, engineers accept this wholeheartedly. An underlying value is, technical incompetence is not ignorance, but stupidity.

Enter Self-Directed Learning, considered a curiosity by most orthodox educators. Knowles describes an application-based approach to professional competence. He suggests that learning is a do-it-yourself project. This resembles heresy to most conventional educators and Malcolm is all-but-excommunicated since his work lacks a "theoretical" base. Now the irony here is, that most engineers see Knowles' concepts as thoughtful and prudent, and most conventional schools of education reject it out of hand. (Knowles) Imagine a world where learning is student-centered. Nonsense. Try to conceive of setting a positive climate as conducive to learning. What a concept! Or even more provocative, that learning should be subject or problem-centered and driven by curiosity or incentive internal to the learner. This is obviously a fantasy. Except to those pragmatic, empirically-driven slaves to solving problems, the engineers.

This is where the disciplines run in parallel. Engineers need to continually learn. Conventional schools distribute learning in two units of measurement: Degrees and semesters. Engineers don't have the luxury of solving problems in units of time called semesters (usually fourteen weeks). They must work in a concept called real-time. Educators do not recognize real-time as a concept. Engineers must become renegade or self-directing. Pragmatism prevails and they become self- directing in their learning. They feel impure. The renegades paraphrase Clemenceau: Learning is too important to be left to the educators. This behavior led to the phenomena called Motorola University or Apple University. The engineers call it, "Not Invented Here" which means that if they didn't invent it, it (the product or process) is not reliable.

Here is where the paradigms converge. Don Schoen and Chris Argyris call for critical self reflection on the part of the professional. Engineers or systems thinkers, like Peter Senge, advocate short feedback loops. (Senge) Engineering education routinely talks about the need to continue learning as fundamental to the excellence of the profession. Even more interesting, the areas cited for development fall in the domain of the human resource developer. A recent collaboration between Arizona State University and the University of Illinois discovered to no one's surprise that an inquiry into the preparedness and importance of dimensions of effectiveness for graduate engineers, had problem-solving as the prime need, followed by interpersonal effectiveness. The interesting aspect of this investigation was that respondents felt that interpersonal effectiveness, especially communication was critical in importance, but low in preparedness. If there ever was a prescription for HR developers, it lies here. Industry says get the skills, engineers say yes, but where? Enter the HR professional.

The partnership is based on the recognition of the need and the availability of the skill to develop interpersonal capability, to name one immediate opportunity. The Human Resource Developer by training and inclination can promote dialogue on this subject, identify and organize a response to the need, and continuously audit, measure and improve the process. The Engineer, often cast in the role of the person resistant to change, or interpersonally backward, will embrace a better way of doing things, if it is apparent. Even learning about subjects like; interpersonal communication, teamwork, motivation and behavior and leadership. As a matter of fact, I have experienced that engineers will be quicker to accept and more likely to use new skills, than many other disciplines. The real issue is how to get these two perspectives to coincide and profit from each other.

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A place to start is the cognitive problem-solving styles of the individuals. Michael Kirton's descriptions of adaptors, bridgers and innovators, provides an effective way to see the similarities of the professions and to articulate a strategy to implement this collaboration. Kirton describes adaptors as those of us who look for a few, well-reasoned solutions to problems that have a high probability for success, and are implemented within the system. Innovators are those who look for as many new ideas as possible to solve problems, without regard for the current system. Innovators take risk with untested ideas and often indict the system as the cause of the problem. Two diametrically opposed views, that can be harmonized by the bridger, who has the inclination to see both sides and can articulate the advantages of both. The bridger seeks precise execution of excellent new ideas. (Kirton) Human resource professionals fall into these preferred styles, and not surprisingly, so do engineers. Usually cast as adaptors, as in slow to change, engineers can be and often are highly innovative in their approach to technical problems. Since Kirton's premise is that we are all adaptive and innovative, but have a preferred style, it is possible for one to be technically innovative and interpersonally adaptive. I believe it is driven by the feelings of competence one has in either domain. Conversely, HR people are often seen as innovative in organizational issues, willing to take risk and challenge conventional wisdom as the situation dictates, but often adapt to business imperatives when intimidated by the bottom line thinking of business leaders (DeLisle, 1992). The bridger looks like the emergent hero, but is too often caught between, and as Yankee manager, Billy Martin once said, "Feel strongly, both ways." So where to start?

Understanding the cognitive problem-solving style of your partner is a start. Innovators can reach innovators, and adaptor-to-adaptor dialogue works. Bridgers can make sense out of the process and help broker the change. HR developers have a skill that engineers categorically need: the understanding and practice of interpersonal effectiveness. Some engineers will adopt it readily, and others more slowly and cautiously. All will embrace new learning if they can see a distinct advantage in doing so. HR professionals are also constrained or enhanced by the same factors. All recognize change, but their styles need to be matched to the situation and the need. Two important steps must be taken to initiate the process of dialogue between the two. These are as old as human nature, but germane in conditions of uncertainty, when most of us resort to our most fundamental values as guides. Simply put, HR developers must learn and accept the dynamics of the processes of engineering. Then we must become skillful in meeting the needs of engineers in these domains. The natural reflex is to assume that adaption is the predominant style. This is not so. HR developers, who often advocate "thinking outside the box" to others, must be astute enough to live outside the box with those engineers who dwell there. Engineers must be true to their professional ethos: Willing to learn new and better ways of articulating their craft. This is easier said than done.

I believe what the two professions would profit from would be a shared paradigm. The image that I often articulate is that the engineer of the future is *technically expert and interpersonally effective* represented in a model of the state of dynamic balance, from statics and dynamics, or low amplitude/high frequency signals from circuit analysis. Images for HR developers might range from hard-headed, soft-hearted management (a la Hewlett-Packard) to the Tao, with yin and yang as harmonized forces. We are not that far away from each other in desire or capability. The question is not when, but how we will respond to the hope and expectation of a new generation of engineers who see the HR professional as their best hope and strongest ally.

The name of this shared paradigm is the socio-technical system. This is the image of a purposeful, product-oriented organization that recognizes and responds to the complexities of the modern world with an equal regard for the contribution of people to the enterprise, as the nature of technological advance. All organizations are socio-technical systems. (Taylor) Engineers and HR developers can make them work if they reflect the recognition of interdependence and opportunity.

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